USER GUIDE AND SPECIFICATIONS
NI WLS/ENET-9163

## Wireless/Ethernet Carrier for NI WLS/ENET-9000 Series Devices

This user guide describes how to use the National Instruments WLS/ENET-9163 carrier and lists specifications.

The NI WLS/ENET-9163 carrier provides a wireless or Ethernet data acquisition interface for a select number of C Series I/O modules. Refer to ni.com/daq for information about which C Series I/O modules are supported by the NI WLS/ENET-9163 carrier.

The NI WLS/ENET-9163 carrier combines with an NI C Series I/O module to form an NI WLS/ENET-9000 Series device, as shown in Figure 1.

Note Only the NI WLS-9163 carrier comes with an antenna for wireless deployment.
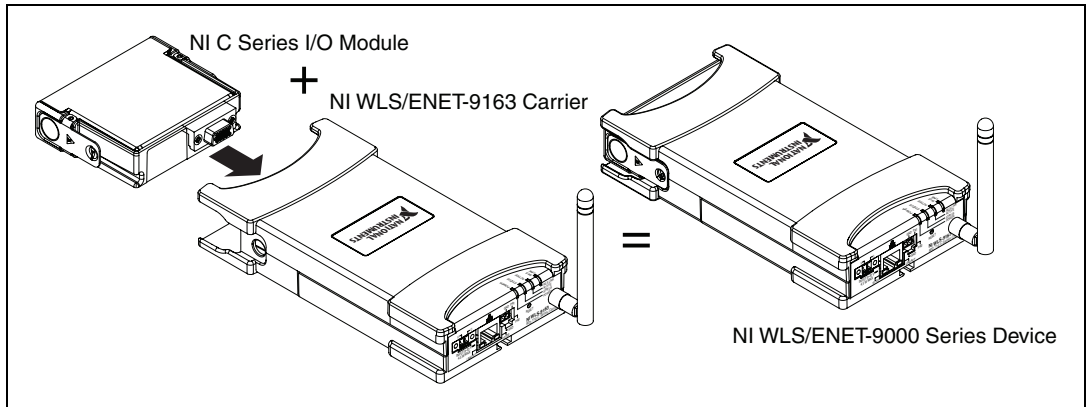
Figure 1. NI WLS/ENET-9163 Carrier Forming the NI WLS/ENET-9000 Series Device

Throughout this manual, the combined NI WLS/ENET-9163 carrier and C Series I/O module is referred to as the NI WLS/ENET-9000 Series device.

![NATIONAL INSTRUMENTS]

Dimensions

Figure 2 shows the NI WLS/ENET-9000 Series device dimensions.

4.012 in.
(101.90 mm)

8.436 in.
(214.27 mm)

7.179 in.
(182.36 mm)

3.745 in.
(95.11 mm)

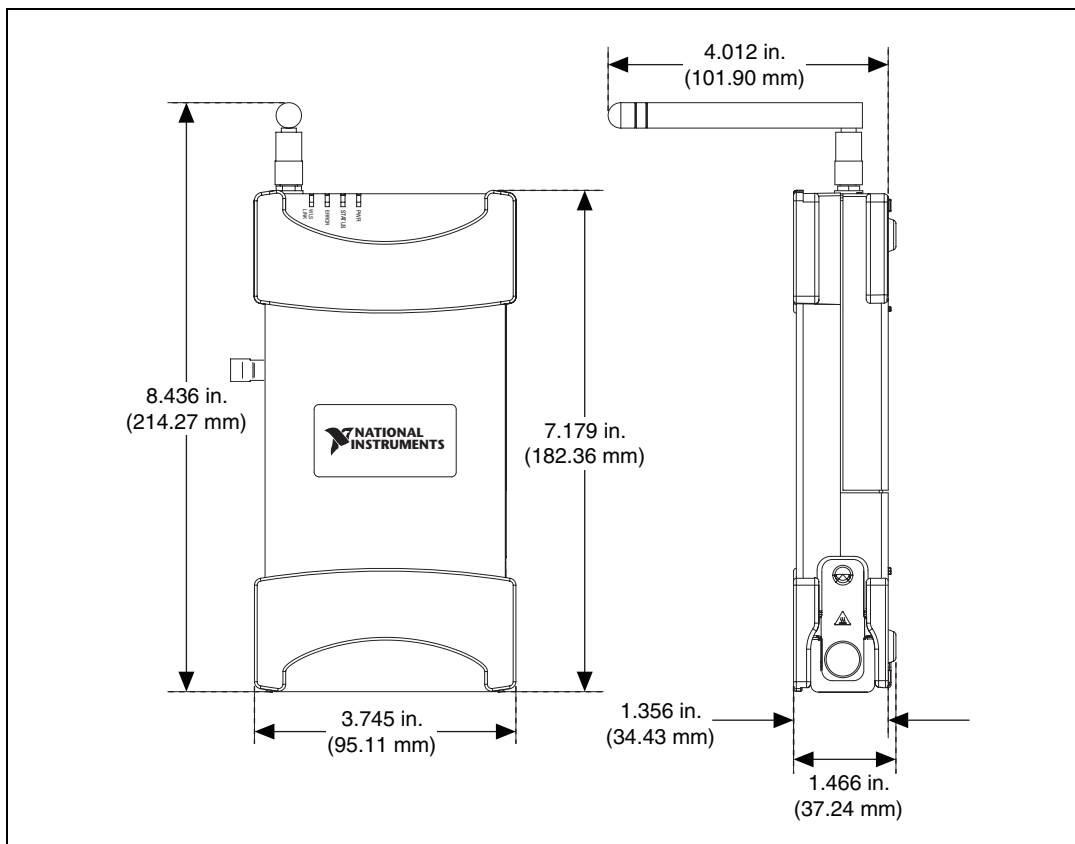1.356 in.
(34.43 mm)

1.466 in.
(37.24 mm)

Figure 2. NI WLS/ENET-9000 Series Device Dimensions

Safety Guidelines

Operate the NI WLS/ENET-9000 Series device only as described in this user guide.

Note   Some C Series I/O modules may have more stringent certification standards than the NI WLS/ENET-9163 carrier, and the combined system may be limited by individual component restrictions.

Caution   The NI WLS/ENET-9000 Series device is *not* certified for use in hazardous locations.

Hot Surface This icon denotes that the component may be hot. Touching this component may result in bodily injury.

Safety Guidelines for Hazardous Voltages

If *hazardous voltages* are connected to the module, take the following precautions. A hazardous voltage is a voltage greater than 42.4 V_{pk} or 60 VDC to earth ground.

Caution Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.

Caution Do *not* mix hazardous voltage circuits and human-accessible circuits on the same module.

Caution Make sure that the NI WLS/ENET-9163 carrier and circuits connected to the module are properly insulated from human contact.

Caution The NI WLS/ENET-9163 carriers provide no isolation, but some modules offer isolation. Follow the safety guidelines for each module when using hazardous voltage.

Related Documentation

Each application software package and driver includes information about writing applications for taking measurements and controlling measurement devices. Check ni.com/manuals for the most recent hardware documentation, and refer to Table 1 for a list of locations for driver and application software documentation. The document location references in this table assume you have NI-DAQmx 8.8 or later, and where applicable, version 7.1 or later of the NI application software.

Table 1. NI Driver and Application Software Documentation

Software	Document/Description	Location/Topic
NI-DAQmx for Windows	*DAQ Getting Started Guide*—describes how to install and use the NI-DAQmx driver software for Windows and your data acquisition (DAQ) device, how to confirm the device is operating properly, and how to take an NI-DAQmx measurement.	**Start»Programs»National Instruments»NI-DAQ» DAQ Getting Started Guide**
	NI-DAQ Readme—includes information about NI-DAQmx.	**Start»Programs»National Instruments»NI-DAQ» NI-DAQ Readme**
	NI-DAQmx Help—explains how to get started in your OS and ADE; provides an NI-DAQmx overview; includes information about programming the most common measurement tasks with references to examples in CVI/C, C++, .NET.	**Start»Programs»National Instruments»NI-DAQ» NI-DAQmx Help**

Table 1. NI Driver and Application Software Documentation (Continued)

Software	Document/Description	Location/Topic
LabVIEW	*Getting Started with LabVIEW*—describes the LabVIEW graphical programming environment and the basic LabVIEW features you use to build data acquisition and instrument control application.	**Start»All Programs»National Instruments»LabVIEW» LabVIEW Manuals** or navigate to the `labview\manuals` directory and opening `LV_Getting_Started.pdf`
	LabVIEW Help—provides information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, and tools.	**Help»Search the LabVIEW Help**
	LabVIEW Help **Topics Specific to NI-DAQmx**	
	Includes overview information and a tutorial to learn how to take an NI-DAQmx measurement in LabVIEW using the DAQ Assistant.	From the Contents tab, **Getting Started»Getting Started with DAQ**
	Describes the LabVIEW NI-DAQmx VIs and properties.	From the Contents tab, **VI and Function Reference» Measurement I/O VIs and Functions**
	Contains the conceptual and how-to information you need to acquire and analyze measurement data in LabVIEW, including common measurements, measurement fundamentals, NI-DAQmx key concepts, and device considerations.	From the Contents tab, **Taking Measurements**

Table 1. NI Driver and Application Software Documentation (Continued)

Software	Document/Description	Location/Topic
LabWindows™/CVI™	*LabWindows/CVI Help* **Data Acquisition** book—contains NI-DAQmx measurement concepts and step-by-step instructions about creating a measurement task using the DAQ Assistant.	**Help»Contents**, then select **Using LabWindows/CVI» Data Acquisition»Taking an NI-DAQmx Measurement in LabWindows/CVI**
	LabWindows/CVI Help **NI-DAQmx Library** book—contains NI-DAQmx API overviews and function reference.	**LibraryReference» NI-DAQmx Library**
Measurement Studio/Microsoft Visual Studio .NET	*Microsoft Visual Studio .NET Help/NI Measurement Studio Help*—contains NI-DAQmx methods and properties.	**Measurement Studio» NI Measurement Studio Help** and select **NI-DAQmx .NET Class Library** or **NI-DAQmx Visual C++ Class Library**
ANSI C without NI Application Software	*NI-DAQmx Help*	**Start»All Programs»National Instruments»NI-DAQ» NI-DAQmx Help**
	NI-DAQmx C Reference Help—describes the NI-DAQmx Library functions.	**Start»All Programs»National Instruments»NI-DAQ» NI-DAQmx C Reference Help**

Table 1. NI Driver and Application Software Documentation (Continued)

Software	Document/Description	Location/Topic
.NET Languages without NI Application Software*	*NI-DAQmx .NET Help*—contains conceptual topics for using NI-DAQmx with Visual C# and Visual Basic .NET.	**Start»All Programs»National Instruments»NI-DAQ» NI-DAQmx .NET Reference Help.** Expand **NI Measurement Studio Help»NI Measurement Studio .NET Class Library»Reference** to view the function reference. Expand **NI Measurement Studio Help» NI Measurement Studio .NET Class Library»Using the Measurement Studio .NET Class Libraries**
	Visual Studio .NET Help—contains conceptual topics for using NI-DAQmx with Visual C# and Visual Basic .NET.	**Help»Contents**. Select **Measurement Studio** from the **Filtered By** drop-down list and follow the location instructions for the *NI-DAQmx .NET Help*.

* With the Microsoft .NET Framework version 1.1 or later, you can use NI-DAQmx to create applications using Visual C# and Visual Basic .NET without Measurement Studio. You need Microsoft Visual Studio .NET 2003 or Microsoft Visual Studio 2005 for the API documentation to be installed.

Device Documentation and Specifications

Check ni.com/manuals for the most recent device and software documentation. If you do not have Web access, NI-DAQmx includes a Documentation CD that includes documentation available when NI-DAQmx released.

Training Courses

If you need more help getting started developing an application with NI products, NI offers training courses. To enroll in a course or obtain a detailed course outline, refer to ni.com/training.

Technical Support on the Web

For additional support, refer to ni.com/support or zone.ni.com.

Installing the Software

NI WLS/ENET-9000 Series device software support for Windows Vista/XP/2000 is provided by NI-DAQmx.

The *DAQ Getting Started Guide*, which is accessible from **Start» Programs»National Instruments»NI-DAQ** or at `ni.com/manuals`, offers NI-DAQmx users step-by-step instructions for installing software and hardware, configuring channels and tasks, and getting started developing an application.

Installing Other Software

If you are using other software, refer to the installation instructions that accompany your software.

Example Programs

The NI-DAQmx CD contains example programs that you can use to get started programming with the NI WLS/ENET-9000 Series device. Refer to the *NI-DAQmx for WLS/ENET Devices Getting Started Guide* that shipped with your device, and is also accessible from **Start»Programs» National Instruments»NI-DAQ**, for more information.

Using the NI WLS/ENET-9000 Series Device

Using the NI WLS/ENET-9000 Series Device on a Desktop

You can use the NI WLS/ENET-9000 Series device on a desktop. Figure 3 shows the stacking grooves for NI ENET-9000 Series devices, and where to apply the rubber standoffs for the NI WLS/ENET-9000 devices. For secure desktop use, you can adhere the supplied rubber standoffs to the underside of the device.

Note **NI ENET-9000 Series Only**—the NI ENET-9000 Series device has underside grooves that allow it to be stacked on top of other NI ENET-9000 Series devices.
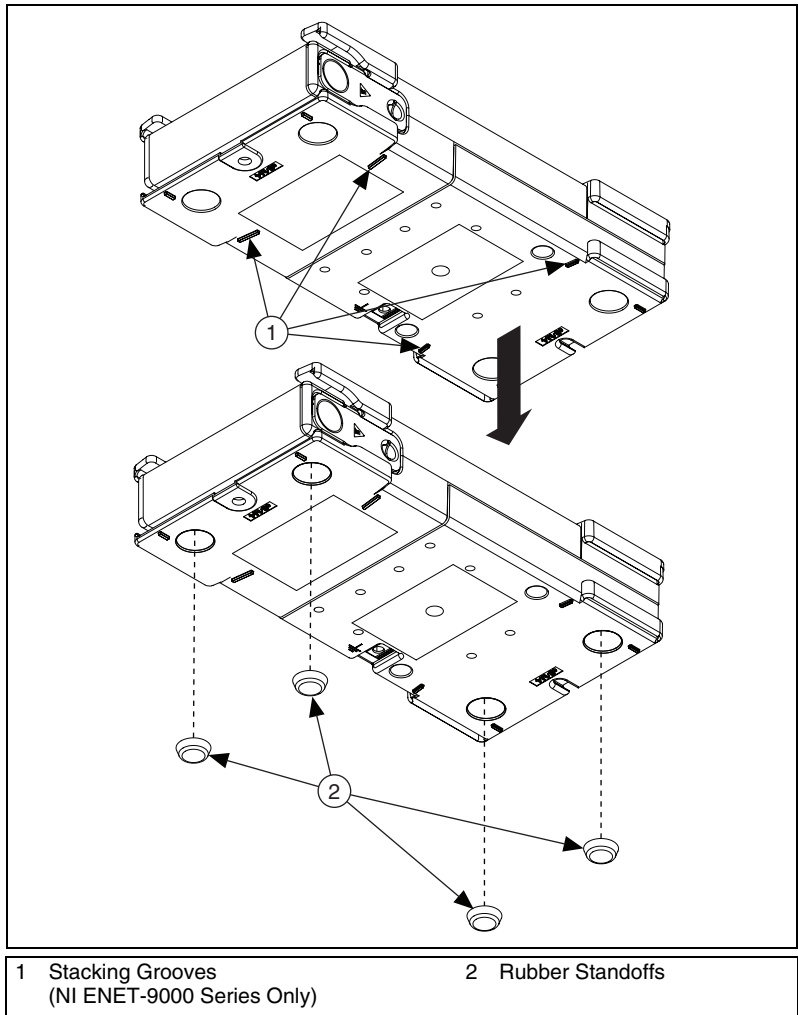
Caution Do *not* stack an NI WLS-9000 Series device on top of an NI WLS-9000 Series device.

Caution This transmitter must *not* be co-located or operated in conjunction with any other antenna or transmitter.

| 1 | Stacking Grooves (NI ENET-9000 Series Only) | 2 | Rubber Standoffs |

Figure 3. Stacking Grooves and Rubber Standoffs for Desktop Use

Mounting the NI WLS/ENET-9000 Series Device

You can mount the NI WLS/ENET-9000 Series device using a 75 mm DIN-Rail kit or a panel mount kit. For kit accessory ordering information, refer to the accessory section of the NI WLS/ENET-9163 product page at ni.com.

⚠️ **Caution** Your installation must meet the following requirements:

- Allows 25.4 mm (1 in.) of clearance above and below the NI WLS/ENET-9000 Series device for air circulation.

- Allows 50.8 mm (2 in.) of clearance in front of modules for common connector cabling, such as the 10-terminal detachable screw terminal connector.

Attaching the NI 9910 DIN-Rail

The NI 9910 DIN-Rail kit contains one clip for mounting the device on a standard 35 mm DIN-Rail. To mount the device on a DIN-Rail, fasten the DIN-Rail clip to the device using a number 2 Phillips screwdriver and four M4 × 17 screws. The screws are included in the DIN-Rail kit. Make sure the DIN-Rail kit is installed as illustrated in Figure 4, with the larger lip of the DIN-RAIL positioned up. When the DIN-Rail kit is properly installed, the NI WLS/ENET-9000 Series device is centered on the DIN-Rail.
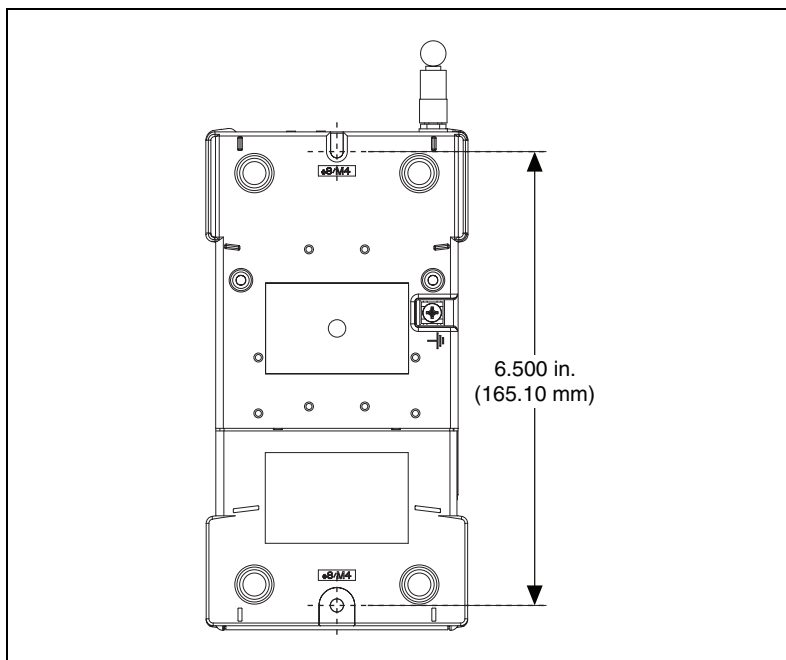
⚠ **Caution** Remove the C Series I/O module before mounting the carrier to the DIN-Rail.
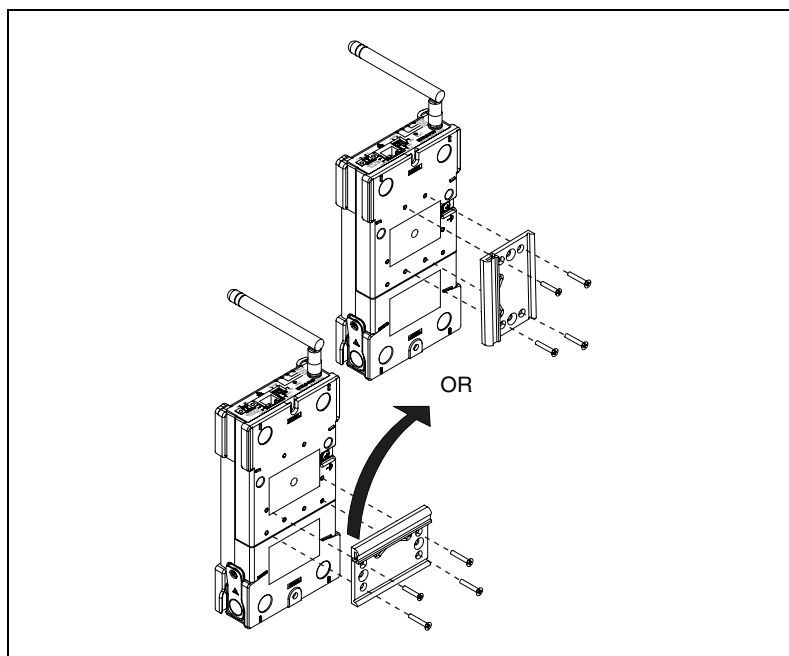
Figure 4. NI WLS/ENET-9000 Series Device DIN-Rail Installation

Mounting the NI WLS/ENET-9000 Series to a Panel

Thread inserts are located in the NI WLS/ENET-9000 Series device for mounting it to a panel. Refer to Figure 5 for dimensions.

Figure 5. Device Panel Mounting Dimensions

⚠ **Caution** Remove the C Series I/O module from the NI WLS/ENET-9163 carrier before you mount the carrier to the panel. After the NI WLS/ENET-9163 carrier is mounted, you can reinsert the C Series module.

Configuring the Ethernet Connection

You must have an Ethernet network in order to use the NI WLS/ENET-9000 Series device. For more information about configuring your Ethernet connection with the NI WLS/ENET-9000 Series device, refer to the *NI-DAQmx for WLS/ENET Devices Getting Started Guide* that shipped with your device. This document is also accessible from **Start»Programs»National Instruments»NI-DAQ**.

Setting Up the NI WLS/ENET-9000 Series Device

Complete the following steps to prepare the NI WLS/ENET-9000 Series device for use:

1. Before connecting the hardware, install NI-DAQmx software, LabVIEW SignalExpress, and the NI-DAQ Device Documentation Browser. Refer to the *DAQ Getting Started Guide* for more information about software installation.

✎ **Note** The NI-DAQmx software is included on the CD shipped with your kit and is available for download at ni.com/support. After you install it, the NI-DAQ Device Documentation Browser is available from **Start»Programs»National Instruments» NI-DAQ»Browse Device Documentation**. The *DAQ Getting Started Guide* is available after installation from **Start»Programs»National Instruments»NI-DAQ»DAQ Getting Started Guide**.

2. If you are not using any mounting accessories or stacking the devices, attach the provided rubber standoffs to the bottom of the NI WLS/ENET-9000 Series device, as described in the *Using the NI WLS/ENET-9000 Series Device on a Desktop* section.

3. Make sure the NI WLS/ENET-9000 Series device power is disconnected.

4. Attach a ring lug, as shown in Figure 6, to a 14 AWG (1.6 mm) wire. Connect the ring lug to the ground terminal on the bottom of the device using the ground screw. Attach the other end of the wire to the system ground.
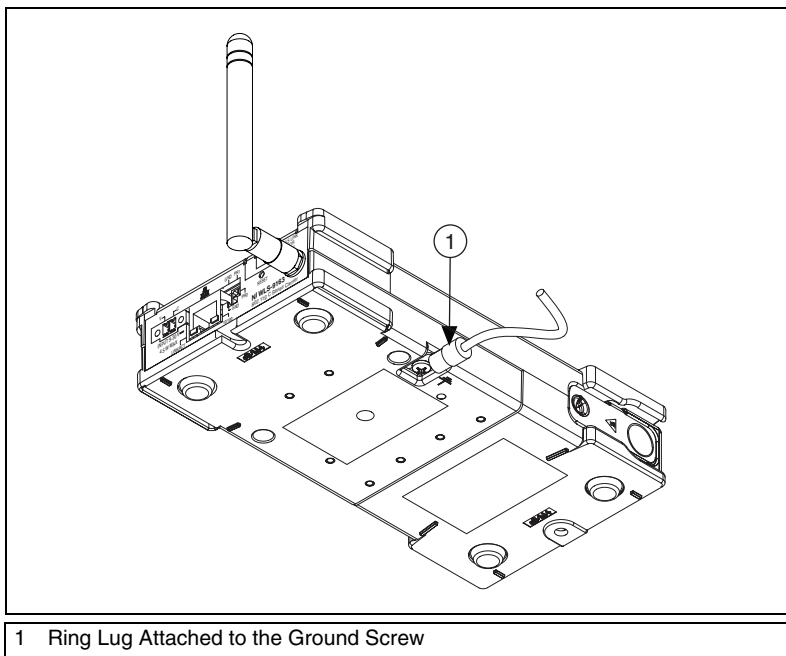
| 1 | Ring Lug Attached to the Ground Screw |

Figure 6. Ring Lug Attached to the Ground Screw

Note Additionally, attach a wire with a ring lug to all other C Series I/O module cable shields. You *must* connect this wire to the ground terminal of the device using the ground screw. The ground terminal of the device should *not* be attached to the common terminal on the C Series I/O module.

Connecting Power to the NI WLS/ENET-9000 Series Device

Power on the NI WLS/ENET-9000 Series device using the included power adapter or other 9–30 VDC power source.
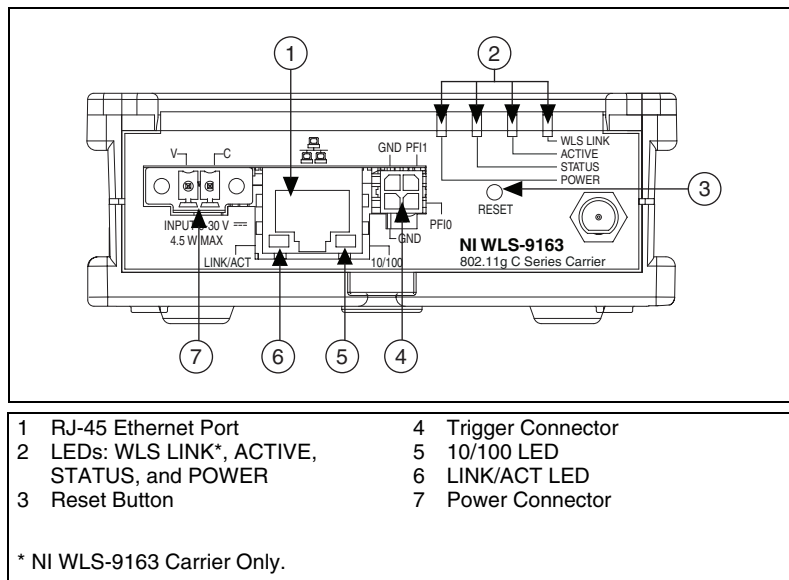
10/100BaseT(X) Ethernet Port Connection

Use the RJ45 port located on the NI WLS/ENET-9000 Series device interface to connect the device to an Ethernet network. Use a standard Category 5 (CAT-5) Ethernet cable (a shielded cable is recommended) to connect the NI WLS/ENET-9000 Series device to an Ethernet hub, or use an Ethernet crossover cable to connect the NI WLS/ENET-9000 Series device directly to a computer.

Note Plug the standard Category 5 Ethernet cable into the RJ-45 Ethernet port on the NI WLS-9000 Series device to configure the wireless network settings. After initial configuration, you can remove the Ethernet cable from the NI WLS-9000 Series device and use the device wireless capabilities.

Device Interface

Figure 7 shows the NI WLS/ENET-9163 carrier interface.

1	RJ-45 Ethernet Port	4	Trigger Connector
2	LEDs: WLS LINK*, ACTIVE, STATUS, and POWER	5	10/100 LED
		6	LINK/ACT LED
3	Reset Button	7	Power Connector

* NI WLS-9163 Carrier Only.

Figure 7. NI WLS/ENET-9163 Carrier Interface

Reset Button

The NI WLS/ENET-9000 Series devices are equipped with a reset button as shown in Figure 7.

Pressing the reset button results in the following device responses:

- When pressed for less than 5 seconds, the device reboots with the current configuration.

- When pressed for 5 seconds or longer, the STATUS LED turns on. When released, the device reboots into Factory Default Mode, which returns the device user configuration to the factory-set defaults.

LED Indicators

The LED indicators for the NI WLS/ENET-9000 Series device are listed in Table 2.

Table 2. LED State/Device Status

LED Description	Color	LED State	Device Status
10/100	Green	On	Connected at 100 Mbps
		Off	No Ethernet connection or 10 Mbps connection
LINK/ACT	Yellow	On	Ethernet link
		Off	No Ethernet connection
		Blinking	Ethernet activity
POWER	Green	On	Power on
		Off	Power off
STATUS	Yellow	On	Device firmware booting or resetting to factory default
		Off	Normal operation
		1 Blink	No C Series module detected
		2 Blinks	Firmware/FPGA image corrupted, update firmware through MAX
		3 Blinks	Firmware error, reboot
ACTIVE	Green	On	A DAQ task is running on the device
		Off	Device available
WLS LINK*	Green	On	Connected and authenticated
		Off	Not connected to access point
* NI WLS-9163 Only			

Pinouts

Trigger Connector
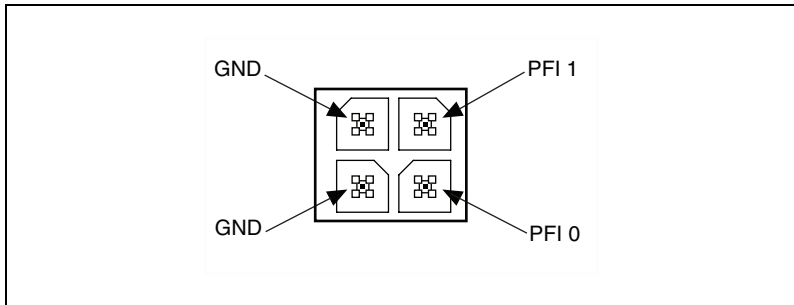
Figure 8. Trigger Connector Pinout

Cabling

Table 3 shows the standard Ethernet cable wiring connections for both normal and crossover cables.

Table 3. Ethernet Cable Wiring Connections

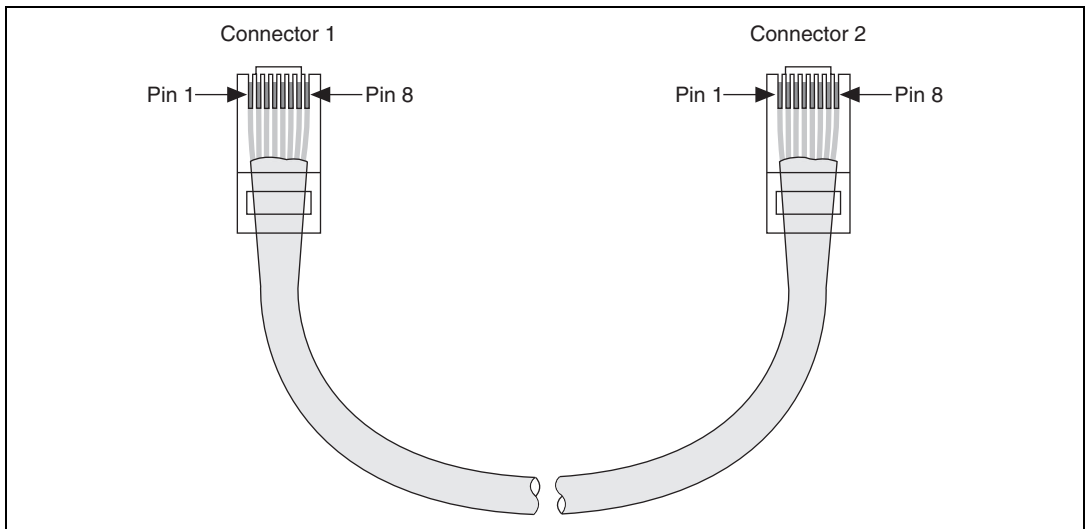| Pin	Connector 1	Connector 2 (Normal)	Connector 2 (Crossover)
1	white/orange	white/orange	white/green
2	orange	orange	green
3	white/green	white/green	white/orange
4	blue	blue	blue
5	white/blue	white/blue	white/blue
6	green	green	orange
7	white/brown	white/brown	white/brown
8	brown	brown	brown

Figure 9. Ethernet Connector Pinout

Using the NI WLS/ENET-9000 Series Device

C Series I/O Modules

National Instruments C Series I/O modules provide built-in signal conditioning and screw terminal, spring terminal, BNC, D-SUB, or RJ-50 connectors. A wide variety of I/O types are available, allowing you to customize the your system to meet your application needs.

You can swap C Series modules when the NI WLS/ENET-9163 carrier is plugged in. After swapping modules, even if it is the same module type, you *must* discover the device through MAX again.

Because the modules contain built-in signal conditioning for extended voltage ranges or industrial signal types, you can make your wiring connections directly from the C Series I/O modules to your sensors/actuators. In most cases, the C Series I/O modules provide isolation from channel-to-earth ground.

AI Sample Timing

The NI WLS/ENET-9000 Series device contains an advanced analog input timing engine. Timing and synchronization signals are available through the PFI lines. Refer to the *Analog Input Timing Signal* section for more information about the configuration of these signals.

Analog Input

To perform analog input measurements, insert a supported analog input C Series I/O module into the NI WLS/ENET-9163 carrier. The measurement specifications, such as number of channels, channel configuration, sample rate, and gain, are determined by the type of C Series I/O module used. For more information and wiring diagrams, refer to the documentation included with your C Series I/O modules.

Analog Input Triggering

A trigger is a signal that causes an action, such as starting or stopping the acquisition of data. When you configure a trigger, you must decide how you want to produce the trigger and the action you want the trigger to cause. The NI WLS/ENET-9000 Series device supports internal software triggering and external digital triggering.

Three triggers are available: *AI Start Trigger Signal*, *AI Reference Trigger Signal*, and *AI Pause Trigger Signal*.

AI Start Trigger Signal

Use the AI Start Trigger (ai/StartTrigger) signal to begin a measurement acquisition. A measurement acquisition consists of one or more samples. If you do not use triggers, begin a measurement with a software command. Once the acquisition begins, configure the acquisition to stop in one of the following ways:

- When a certain number of points is sampled (in finite mode)
- With a software command (in continuous mode)

An acquisition that uses a start trigger is sometimes referred to as a posttriggered acquisition. That is, samples are measured only after the trigger.

Using a Digital Source

To use ai/StartTrigger with a digital source, specify a source and an edge.

NI-DAQmx can provide an internal start trigger or PFI 0 may be used.

Refer to the *Device Routing in MAX* topic in the *NI-DAQmx Help* or the *LabVIEW Help* in version 8.0 or later for more information.

The *NI-DAQmx Help* is available after installation from **Start» Programs» National Instruments»NI-DAQ»NI-DAQmx Help**. To view the *LabVIEW Help,* in version 8.0 or later, select **Help»Search the LabVIEW Help** in LabVIEW. Alternately, to download the *LabVIEW Help,* go to `ni.com/manuals`.

You also can specify whether the measurement acquisition begins on the rising edge or falling edge of ai/StartTrigger.

Routing AI Start Trigger to an Output Terminal

You can route ai/StartTrigger to the PFI 0 terminal. The output polarity is selectable.

AI Reference Trigger Signal

Use a reference trigger (ai/ReferenceTrigger) signal to stop a measurement acquisition. To use a reference trigger, specify a buffer of finite size and a number of pretrigger samples (samples that occur before the reference trigger). The number of posttrigger samples (samples that occur after the reference trigger) desired is the buffer size minus the number of pretrigger samples.

When the acquisition begins, the NI WLS/ENET-9000 Series device begins to fill the buffer. After the specified number of pretrigger samples are captured, the NI WLS/ENET-9000 Series device begins to look for the reference trigger condition. If the reference trigger condition occurs before the NI WLS/ENET-9000 Series device captures the specified number of pretrigger samples, the NI WLS/ENET-9000 Series device ignores the condition.

If the buffer becomes full, the NI WLS/ENET-9000 Series device continuously discards the oldest samples in the buffer to make space for the next sample. This data can be accessed with some limitations before the NI WLS/ENET-9000 Series device discards it. Refer to the KnowledgeBase document, *Can a Pretriggered Acquisition be Continuous?*, for more information. To access this KnowledgeBase, go to `ni.com/info` and enter the info code rdcanq.

When the reference trigger occurs, the NI WLS/NET-9163 Series device continues to write samples to the buffer until the buffer contains the number of posttrigger samples desired. Figure 10 shows the final buffer.
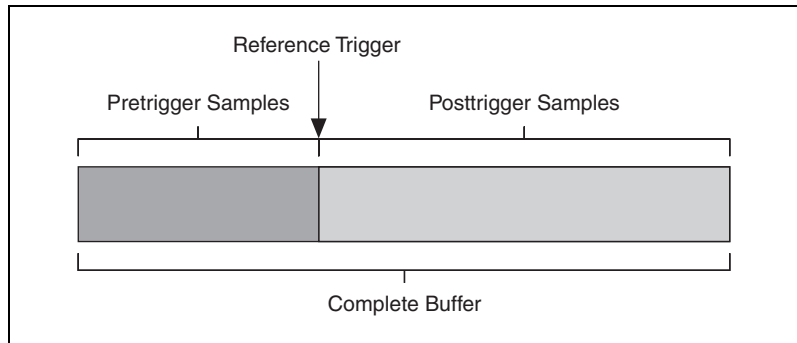
Figure 10. Reference Trigger Final Buffer

Using a Digital Source

To use ai/ReferenceTrigger with a digital source, specify a source and an edge. PFI 0 can provide the source. Refer to the *Device Routing in MAX* topic in the *NI-DAQmx Help* or the *LabVIEW Help* in version 8.0 or later for more information.

The *NI-DAQmx Help* is available after installation from **Start»Programs» National Instruments»NI-DAQ»NI-DAQmx Help**. To view the *LabVIEW Help,* in version 8.0 or later, select **Help»Search the LabVIEW Help** in LabVIEW. Alternately, to download the *LabVIEW Help,* go to `ni.com/manuals`.

You also can specify whether the measurement acquisition stops on the rising edge or falling edge of ai/ReferenceTrigger.

AI Pause Trigger Signal

The Pause Trigger signal can be generated from external sources. Any time the signal deasserts, you can use the Pause Trigger signal to pause the acquisition.

You can use the AI Pause Trigger (ai/PauseTrigger) signal to pause and resume a measurement acquisition. The internal sample clock pauses while the external trigger signal is active and resumes when the signal is inactive. You can program the active level of the pause trigger to be high or low.

Using a Digital Source

To use ai/PauseTrigger, specify a source and a polarity on PFI 0.

**Note** Pause triggers are only sensitive to the level of the source, not the edge.

Analog Input Timing Signal

AI Sample Clock

A sample consists of one reading from each channel in the AI task. ai/SampleClock signals the start of a sample of all analog input channels in the task. ai/SampleClock can be generated from external or internal sources.

Using A Digital Source

To use ai/SampleClock, specify a source and an edge on PFI 1. For more information, refer to the *Device Routing in MAX* topic in the *NI-DAQmx Help*.
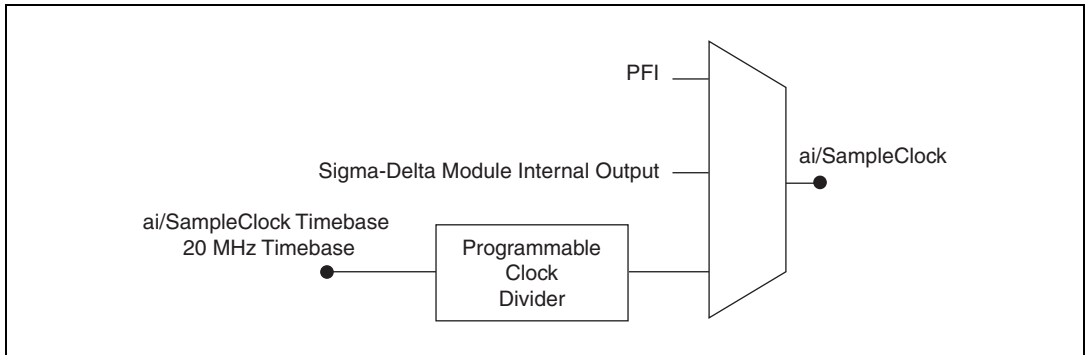
Figure 11. Sample Clock Timing Options

Routing AI Sample Clock to an Output Terminal

You can route ai/SampleClock to the PFI 1 terminal.

Convert Behavior For Analog Input Modules

Scanned

Scanned C Series analog input modules contain a single A/D converter and a multiplexer to select between multiple input channels. When the C Series Module Interface receives a Sample Clock pulse, it begins generating a Convert Clock for each scanned module in the current task. Each Convert Clock signals the acquisition of a single channel from that module. The Convert Clock rate depends on the module being used, the number of channels, and the Sample Clock rate.

Simultaneous Sample-and-Hold

Simultaneous sample-and-hold (SSH) C Series analog input modules contain multiple A/D converters or circuitry that allows all the input channels to be sampled at the same time. These modules sample their inputs on every AI Sample Clock pulse.

Sigma-Delta

Sigma-Delta C Series analog input modules function much like SSH modules, but use A/D converters that require a high-frequency oversample clock to produce accurate, synchronized data.

This clock is used as the AI Sample Clock Timebase. While most modules supply a common oversample clock frequency (12.8 MHz), some modules, such as the NI 9234, supply a different frequency. The sampling is an integer divisor of the frequency of the AI Sample Clock Timebase.

Getting Started with AI Applications in Software

You can use the NI WLS/ENET-9000 Series device in the following analog input applications:

- Single-Point
- Finite
- Continuous

For more information about programming analog input applications and triggers in software, Refer to the *NI-DAQmx Help* or the *LabVIEW Help* in version 8.0 or later for more information.

The *NI-DAQmx Help* is available after installation from **Start»Programs» National Instruments»NI-DAQ»NI-DAQmx Help**. To view the *LabVIEW Help,* in version 8.0 or later, select **Help»Search the LabVIEW Help** in LabVIEW. Alternately, to download the *LabVIEW Help,* go to ni.com/manuals.

Specifications

These specifications are typical at 25 °C unless otherwise noted.

For C Series I/O module specifications, refer to the documentation included with the modules.

✒️ **Note** These specifications are for the NI WLS/ENET-9163 carrier only, unless otherwise noted.

Analog Input

Input FIFO size .... 4095 samples >16 bit
8191 samples ≤16 bit

Sample rate[1]
NI WLS/ENET-9163 carrier........... 5 MS/s (multi-channel, aggregate), maximum
With NI WLS/ENET-9215 .... 100 kS/s, maximum

Timing accuracy[2] .... 50 ppm of sample rate

Timing resolution[2] .... 50 ns

Number of channels supported .... Determined by the C Series I/O module

Digital Triggers

Static Characteristics

Number of terminals .... 2 bi-directional, individually settable

Pull-down resistor .... 49.9 kΩ ±0.5%

Input voltage protection[3] .... ±20 V on each pin

Power–on state .... Input

Required minimum input pulse width.... 100 ns

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[1] Performance dependent on type of installed C Series I/O modules and number of channels in the task.

[2] Does not include group delay. Refer to C Series I/O module documentation for more information.

[3] Stresses beyond those listed under *Input voltage protection* may cause permanent damage to the device.

PFI Functionality

PFI 1 ....Sample Clock In,
Sample Clock Out[1]
PFI 0 ....Start Trigger In, Start Trigger
Out, Pause In, Reference
Trigger In

Maximum Operation Conditions

Level	Min	Max
I_{OL} output low current	—	8 mA
I_{OH} output high current	—	–8 mA

Digital Input Characteristics

Level	Min	Max
V_{IL} input low voltage	0 V	0.8 V
V_{IH} input high voltage	2 V	5 V
I_{IL} input low current (V_{in} = 0 V)	—	–15 μA
I_{IH} input high current (V_{in} = 5 V)	—	120 μA

Digital Output Characteristics

Parameter	Voltage Level	Current Level
V_{OL}	0.5 V	6 mA
V_{OH}	4.0 V	–6 mA

Wireless (NI WLS-9163 Carrier Only)

Radio mode ....IEEE 802.11b, 802.11g

Wireless mode ....Ad-Hoc and Infrastructure

Frequency range ....2.412–2.462 GHz

Channel[2]..1–14

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[1] Module-dependent.

[2] Due to regulations, the valid channels depend upon in which country the device is operating.

Security ....WEP-40, WEP-104, WPA, WPA2

      EAP Type ....LEAP, PEAP[1], TTLS[2], TLS

Center frequency

      11b ....2412–2484 MHz

      11g ....2412–2472 MHz

Channel interval

      11b ....5 MHz

      11g ....5 MHz

Modulation type

      11g ....OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)

      11b ....DSSS (CCK, DQPSK, DBPSK)

TX power

Specification	Channel	Maximum Radio Output
11g	1	12 dBm
	2	16 dBm
	3, 4	15.5 dBm
	5–7	15 dBm
	8–10	14.5 dBm
	11–13	14 dBm
11b	1–14	16 dBm

Receiver Sensitivity

11b, FER<8%

      11 Mbps ....–82 dB/min

      5.5 Mbps ....–84 dB/min

      2 Mbps ....–86 dB/min

      1 Mbps ....–88 dB/min

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[1] Only PEAPv0/MS-CHAPv2 is supported.

[2] Only CHAP and MS-CHAPv2 are supported.

11g, PER<10%

54 Mbps ....–68 dB/min

48 Mbps ....–68 dB/min

36 Mbps ....–75 dB/min

24 Mbps ....–79 dB/min

18 Mbps ....–82 dB/min

12 Mbps ....–84 dB/min

9 Mbps ....–87 dB/min

6 Mbps ....–88 dB/min

Antenna (NI WLS-9163 Carrier Only)

Connector...Female RP-SMA connector

Electrical performance

Property	Performance
VSWR	Max. 2.0 (2.4–2.5 GHz)
Impedance	50 Ω nominal
Directivity	Omni
Max. gain	2.0 dBi (2.4–2.5 GHz)

Ethernet

Network interface ....100 Base-TX, full-duplex; 100 Base-TX, half-duplex; 10 Base-T, full-duplex; 10 Base-T, half-duplex

Network protocols ....TCP/IP, UDP

Network ports used ....HTTP:80 (configuration only), HTTPS:43 (configuration only), TCP:31415, UDP:44515

Network IP configuration ....DHCP + Link–Local, DHCP, Static, Link–Local

Communication rates ....10/100 Mbps, auto-negotiated

Maximum cabling distance.....................100 m/segment

Module I/O States

At power-on .... Module-dependent. Refer to the documentation included with the C Series I/O module.

Power Requirements

⚠ **Caution** You must use a National Electric Code (NEC) UL Listed Class 2 power supply with NI WLS/ENET-9000 Series devices.

📝 **Note** Some C Series I/O modules have additional power requirements. For more information about the C Series I/O module power requirements, refer to the documentation included with the C Series I/O module.

Input voltage range................................. 9 V to 30 V

Maximum required input power .... 4.5 W

Power input mating connector .... 2 position combicon, Phoenix Contact part number: 1714977

Physical Characteristics

Weight... Approx. 242 g (8.5 oz)

Weight with antenna
(NI WLS-9163 Only)............................. Approx. 256 g (9 oz)

Dimensions... 182 mm × 95 mm × 37 mm (7.18 in. × 3.75 in. × 1.50 in.)

With rubber feet attached...................... +3.56 mm (+0.140 in.)

Antenna

Antenna connector
(antenna not attached) .... +5.71 mm (+0.225 in.)

Attached, fully extended .... +108.7 mm (+4.28 in.)

📝 **Note** Refer to the *Dimensions* section for device dimensions with the antenna attached.

Safety Standards

If you need to clean the carrier, wipe it with a dry towel.

The NI WLS/ENET-9163 carrier is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1
- EN 50371[1]

📝 **Note** For UL and other safety certifications, refer to the product label, or go to `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.[1]

Safety Voltages

Connect only voltages that are within these limits.

V terminal to C terminal.........................30 V max, Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

⚠️ **Caution** Do not connect the system to signals or use for measurements within Measurement Categories II, III, or IV.

RF Safety Warning (NI WLS-9163 Carrier Only)

This equipment complies with FCC radiation exposure limits set for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This product generates and radiates radio frequency energy. To comply with the radio frequency radiation exposure guidelines in an uncontrolled environment, this equipment should be installed and operated with at least 20 cm and more between the radiator and the person's body (excluding extremities: hands, wrists, feet, and legs).

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[1] NI WLS-9163 carrier only.

Environmental

The NI WLS/ENET-9163 carrier is intended for indoor use only. For outdoor use, mount the system in a suitably rated enclosure.

Operating temperature
(IEC-60068-2-1 and IEC-60068-2-2) .... 0 to 55 °C

Storage temperature
(IEC-60068-2-1 and IEC-60068-2-2) .... –10 to 70 °C

Ingress protection .... IP 30

Operating humidity
(IEC-60068-2-56) .... 10 to 90% RH, noncondensing

Storage humidity (IEC-60068-2-56) ...... 5 to 90% RH, noncondensing

Maximum altitude .... 2,000 m

Pollution Degree (IEC 60664) 2

Shock and Vibration

To meet these specifications, you must panel mount the NI WLS/ENET-9163 carrier and affix ferrules to the ends of the terminal lines.

Operational shock .... 30 g peak, half-sine, 11 ms pulse
(Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)

Random vibration
    Operating .... 5 to 500 Hz, 0.3 g_{rms}
    Nonoperating .... 5 to 500 Hz, 2.4 g_{rms}
(Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity

- EN 55011 Emissions; Group 1, Class A

- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

- EN 301489-01[1], EN 301489-17[1]

- FCC 15-247[1], IC RSS-210[1], EN 300328[1]

Note For EMC compliance, operate this device according to product documentation. For country-specific restrictions, go to `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column

Electronic Compatibility Information

This hardware has been tested and found to comply with the applicable regulatory requirements and limits for electromagnetic compatibility (EMC) as indicated in the hardware's Declaration of Conformity (DoC). These requirements and limits are designed to provide reasonable protection against harmful interference when the hardware is operated in the indicated electromagnetic environment. In special cases, for example when either highly sensitive or noisy hardware is being used in close proximity, additional mitigation measures may have to be employed to minimize the potential for electromagnetic interference.

While this hardware is compliant with the applicable regulatory EMC requirements, there is no guarantee that interference will not occur in a particular installation. To minimize the potential for the hardware to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this hardware in strict accordance with the instructions in the hardware documentation and the DoC.

If this hardware does cause interference with licensed radio communications services or other nearby electronic hardware, which can be determined by turning the hardware off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna of the receiver (the device suffering interference).

- Relocate the transmitter (the device generating interference) with respect to the receiver.

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[1] NI WLS-9163 carrier only.

- Plug the transmitter into a different outlet so that the transmitter and the receiver are on different branch circuits.

This hardware may generate emissions that exceed regulatory requirements or may become more sensitive to disturbances in the local electromagnetic environment when test leads are attached or when connected to a test object.

Operation of this hardware in a residential area is likely to cause harmful interference. Users are required to correct the interference at their own expense or cease operation of the hardware.

Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the hardware under the local regulatory rules.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility (EMC) Directive
- 1999/5/EC[1]; Radio and Telecommunications Terminal Equipment (R&TTE) Directive

EU Regulatory Statements

cs	Česky [Czech]	*National Instruments* tímto prohlašuje, _e tento NI WLS/ENET-9163 je ve shodě se základními po_adavky a dalšími příslušnými ustanoveními směrnice 1999/5/ES.
da	Dansk [Danish]	Undertegnede *National Instruments* erklćrer herved, at fťlgende udstyr NI WLS/ENET-9163 overholder de vćsentlige krav og ťvrige relevante krav i direktiv 1999/5/EF.
de	Deutsch [German]	Hiermit erklärt *National Instruments*, dass sich das Gerät NI WLS/ENET-9163 in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.
et	Eesti [Estonian]	Käesolevaga kinnitab*National Instruments* seadme NI WLS/ENET-9163 vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
en	English	Hereby, *National Instruments*, declares that this NI WLS/ENET-9163 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
es	Español [Spanish]	Por medio de la presente *National Instruments* declara que el NI WLS/ENET-9163 cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.

	Ελληνική [Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ *National Instruments* ΔΗΛΩΝΕΙ ΟΤΙ NI WLS/ENET-9163 ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ.
	Français [French]	Par la présente *National Instruments* déclare que l'appareil NI WLS/ENET-9163 est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
	Italiano [Italian]	Con la presente *National Instruments* dichiara che questo NI WLS/ENET-9163 è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
	Latviski [Latvian]	Ar šo *National Instruments* deklarē, ka NI WLS/ENET-9163 atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
	Lietuvių [Lithuanian]	Šiuo *National Instruments* deklaruoja, kad šis NI WLS/ENET-9163 atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
	Nederlands [Dutch]	Hierbij verklaart *National Instruments* dat het toestel NI WLS/ENET-9163 in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.
	Malti [Maltese]	Hawnhekk, *National Instruments*, jiddikjara li dan NI WLS/ENET-9163 jikkonforma mal-htigijiet essenzjali u ma provvedimenti ohrajn relevanti li hemm fid-Dirrettiva 1999/5/EC.
	Magyar [Hungarian]	Alulírott, *National Instruments* nyilatkozom, hogy a NI WLS/ENET-9163 megfelel a vonatkozó alapvető követelményeknek és az 1999/5/EC irányelv egyéb előírásainak.
	Polski [Polish]	Niniejszym *National Instruments*. oświadcza, że NI WLS/ENET-9163 jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.
	Português [Portuguese]	*National Instruments* declara que este NI WLS/ENET-9163 está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.
	Slovensko [Slovenian]	*National Instruments* izjavlja, da je ta NI WLS/ENET-9163 v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/ES.
	Slovensky [Slovak]	*National Instruments* týmto vyhlasuje, _e NI WLS/ENET-9163 spĺňa základné po_iadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.
	Suomi [Finnish]	*National Instruments* vakuuttaa täten että NI WLS/ENET-9163 tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
	Svenska [Swedish]	Härmed intygar *National Instruments* att denna NI WLS/ENET-9163 står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
	Íslenska [Icelandic]	Hér með lýsir *National Instruments* yfir því að NI WLS/ENET-9163 er í samræmi við grunnkröfur og aðrar kröfur, sem gerðar eru í tilskipun 1999/5/EC.
	Norsk [Norwegian]	*National Instruments* erklærer herved at utstyret NI WLS/ENET-9163 er i samsvar med de grunnleggende krav og øvrige relevante krav i direktiv 1999/5/EF.

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee.htm`.

电子信息产品污染控制管理办法 （中国 **RoHS**）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

Regulatory Information[1]

United States

This product generates and radiates radio frequency energy. To comply with the radio frequency radiation exposure guidelines in an uncontrolled environment, this equipment must be installed and operated while maintaining a minimum body-to-antenna distance of 20 cm.

This product complies with Part 15 of the FCC Rules. Operation is subject to these two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This product does not contain any user serviceable components. Any unauthorized product changes or modifications will invalidate the warranty and all applicable regulatory certifications and approvals.

Canada

This product complies with Industry Canada RSS-210.

Cet appareil est conforme aux norme RSS210 d'Industrie Canada.

Europe—EU Declaration of Conformity C E (!)

Marking by the above CE symbol on the label indicates compliance with the Essential Requirements of the R&TTE Directive of the European Union (1999/5/EC). This equipment meets the following conformance standards: EN 300 893, EN300 328, EN301 489-17, EN60950.

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[1] NI WLS-9163 only.

Europe – Restrictions for Use of 2.4 GHz Frequencies in European Community Countries

België/ Belgique:	For private usage outside buildings across public grounds over less than 300m no special registration with IBPT/BIPT is required. Registration to IBPT/BIPT is required for private usage outside buildings across public grounds over more than 300m. For registration and license please contact IBPT/BIPT.
	Voor privé-gebruik buiten gebouw over publieke groud over afstand kleiner dan 300m geen registratie bij BIPT/IBPT nodig; voor gebruik over afstand groter dan 300m is wel registratie bij BIPT/IBPT nodig. Voor registratie of licentie kunt u contact opnemen met BIPT.
	Dans le cas d'une utilisation privée, à l'extérieur d'un bâtiment, au-dessus d'un espace public, aucun enregistrement n'est nécessaire pour une distance de moins de 300m. Pour une distance supérieure à 300m un enregistrement auprès de I'IBPT est requise. Pour les enregistrements et licences, veuillez contacter I'IBPT.
Deutschland:	License required for outdoor installations. Check with reseller for procedure to follow.
	Anmeldung im Outdoor-Bereich notwendig, aber nicht genehmigungspflichtig.Bitte mit Händler die Vorgehensweise abstimmen.
France:	Restricted frequency band: only channels 1 to 7 (2400 MHz and 2454 MHz respectively) may be used outdoors in France.
	Bande de fréquence restreinte : seuls les canaux 1- 7 (2400 et 2454 MHz respectivement) doivent être utilisés endroits extérieur en France. Vous pouvez contacter I'Autorité de Régulation des Télécommuniations (http://www.art-telecom.fr) pour la procédure à suivre.
Italia:	License required for indoor use. Use with outdoor installations not allowed.
	E'necessaria la concessione ministeriale anche per l'uso interno.
	Verificare con i rivenditori la procedura da seguire.
Nederland:	License required for outdoor installations. Check with reseller for procedure to follow.
	Licentie verplicht voor gebruik met buitenantennes. Neem contact op met verkoper voor juiste procedure.

Japan

The certified radio equipment is embedded in this device.

本機器には認証済み無線設備が内蔵されています

Where to Go for Support

National Instruments corporate headquarters is located at
11500 North Mopac Expressway, Austin, Texas, 78759-3504.
National Instruments also has offices located around the world to help
address your support needs. For telephone support in the United States,
create your service request at `ni.com/support` and follow the calling
instructions or dial 512 795 8248. For telephone support outside the United
States, contact your local branch office:

Australia 1800 300 800, Austria 43 662 457990-0,
Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599,
Canada 800 433 3488, China 86 21 5050 9800,
Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,
Finland 358 (0) 9 725 72511, France 01 57 66 24 24,
Germany 49 89 7413130, India 91 80 41190000, Israel 972 3 6393737,
Italy 39 02 41309277, Japan 0120-527196, Korea 82 02 3451 3400,
Lebanon 961 (0) 1 33 28 28, Malaysia 1800 887710,
Mexico 01 800 010 0793, Netherlands 31 (0) 348 433 466,
New Zealand 0800 553 322, Norway 47 (0) 66 90 76 60,
Poland 48 22 3390150, Portugal 351 210 311 210, Russia 7 495 783 6851,
Singapore 1800 226 5886, Slovenia 386 3 425 42 00,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 (0) 8 587 895 00, Switzerland 41 56 2005151,
Taiwan 886 02 2377 2222, Thailand 662 278 6777,
Turkey 90 212 279 3031, United Kingdom 44 (0) 1635 523545